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At-a-glance

Impact of drug overdose-related deaths on life expectancy at birth in British Columbia

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Abstract

We quantified the contributions of leading causes of death and drug overdose to changes in life expectancy at birth over time and inequalities by sex and socioeconomic status in British Columbia. From 2014 to 2016, life expectancy at birth declined by 0.38 years and drug overdose deaths (mainly opioid-involved) contributed a loss of 0.12 years of the decrease. The analysis also demonstrated that the higher drug overdose mortality among males and among those in lower socioeconomic status communities contributed to a differential decrease in life expectancy at birth for males and for those in the latter category.

Keywords: *opioid overdose death, life expectancy at birth, inequality*

Highlights

- Life expectancy at birth (LE_0) in BC decreased by 0.38 years from 2014 to 2016, and fatal drug overdoses (the majority involving opioids) accounted for 32% of the decrease.
- In 2016, LE_0 for males was 4.59 years lower than that for females, and drug overdose mortality accounted for 9% of this gap.
- In 2016, LE_0 for those in communities with the highest deprivation index (quintile 5 or lowest socio-economic status) was 5.58 years lower compared to people who live in communities with the lowest deprivation index (quintile 1 or highest socio-economic status), and drug overdose mortality accounted for 7% of this gap.

Introduction

The number of illicit drug overdose deaths has dramatically increased in British Columbia (BC) since 2014, from 369 deaths in 2014 to 1208 deaths (including suspected cases) as of October 31, 2017.[1] Fentanyl or its analogues, in combination with other drugs, accounted for the majority of illicit drug overdose deaths.[2] In response to the increasing drug overdose crisis, a public health emergency was declared on April 14, 2016 in BC.[3]

The contribution of drug overdose deaths to life expectancy change has rarely been quantified. Between 2000 and 2014, unintentional poisonings (mostly drug and alcohol overdoses) contributed a loss of 0.338 years in life expectancy at birth (LE_0) for the non-Hispanic white population in the United States of America (USA), the greatest negative impact by cause of death.[4] Specifically, opioid-involved overdose deaths contributed to a loss of 0.21 years in LE_0 for the entire USA population between 2000 and 2015.[5] In this article, we sought to adapt the analysis to the BC setting and to further expand the analysis by quantifying the contribution of opioid and other drug overdose deaths to life expectancy inequalities by sex and socioeconomic status (SES).

Methods

We obtained data on deaths recorded by the BC Vital Statistics Agency during 2001–2016. We used the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10) to classify causes of deaths. We identified deaths involved opioids (T40.0, T40.1, T40.2, T40.3, T40.4, T40.6), cocaine (T40.5) and other drugs (T40.7, T40.8, T40.9). Those classified as unintentional injuries (X40–X44) or undetermined intent (Y10–Y14) were included in the analysis. We calculated mortality using the insured population in the province and used the 2001 population as the reference to standardize mortality rates.

We used the Chiang method[6] to construct period life tables and calculated LE_0 gaps between 2001 and 2016 and between 2014 and 2016. We examined LE_0 inequalities by sex and by deprivation index. Deprivation index, an area-based SES measurement including material deprivation (a composite of household income, unemployment and high school graduation) and social deprivation (a composite of marital status, living alone and residential stability), was constructed using the 2011 Canadian Census according to the method described by Pampalon et al.[7] A lower score for this index indicates a better SES (less deprivation). We partitioned the gaps into age and leading cause of death including drug overdose using Arriaga's decomposition method.[8] Analyses

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were undertaken using SAS version 9.3 (SAS Institute Inc., Cary, NC, USA).

Results

LE_0 in BC increased from 80.27 years (95% confidence interval [CI] 80.12–80.42) in 2001 to 83.02 years (95% CI 82.88–83.16) in 2014. However, from 2014 to 2016, LE_0 decreased by 0.38 years to 82.64 years (95% CI 82.50–82.77) (Table 1). Reduced mortality rates for cancers, heart diseases, cerebrovascular diseases and accidents contributed to the majority of the 2.37-year increase in LE_0 during 2001 and 2016. However, deaths involving any type of drugs caused a loss of 0.15 years to LE_0 during this period. Opioid-involved deaths accounted for nearly 80% of overall drug overdose deaths in 2001, but this increased to 90% in 2016. The increase in opioid-involved deaths contributed a loss of 0.16 years to LE_0 in 2016, compared to 2001. Drug overdose deaths contributed a loss of 0.12 years in 2016 compared to 2014, accounting for 32% of the total decline during this period.

In 2001, LE_0 for males was 5.01 years lower than that for females (Table 2). The higher drug overdose mortality in males contributed 0.20 years to the gap, but the majority were attributed to cancer, heart disease and injury (accidents and suicide) deaths. While the sex difference in LE_0 declined to 4.59 years in 2016, the contribution by drug overdose deaths doubled to 0.42 years (accounting for 9% of the gap). Drug overdose mortality rates were inversely associated with both material and social deprivation index. In 2011, LE_0 for the population living in the highest total deprivation level (quintile 5 or the lowest SES) communities was 5.50 years lower than that for the population living in the lowest total deprivation level

TABLE 1
Contributions of leading causes of death and drug overdose to the changes in life expectancy at birth in BC

	Year 2001		Year 2014		Year 2016		Change and contributions (in years) by selected causes of death to the life expectancy at birth change in 2016			
							Change from 2001	Contribution[a]	Change from 2014	Contribution[a]
Life expectancy (in years)	80.27		83.02		82.64		2.37		−0.38	
Number of deaths and age-standardized mortality rate (per 100 000 population) by cause of death	**Number**	**Rate**	**Number**	**Rate**	**Number**	**Rate**				
Cancer	7799	196.4	9948	170.2	10 170	162.8	−17.1%	0.66	−4.3%	0.15
Heart diseases	6875	173.2	6121	95.2	6456	93.5	−46.0%	1.27	−1.8%	0.02
Cerebrovascular disease	2297	57.9	2175	34.1	2320	33.7	−41.8%	0.36	−1.2%	0.01
Chronic lower respiratory diseases	1299	32.7	1590	26.1	1801	27.5	−16.1%	0.08	5.1%	−0.03
Diabetes	707	17.8	1595	26.2	1670	25.8	45.1%	−0.13	−1.3%	0.01
Unintentional injuries	1018	25.6	1088	19.6	816	13.7	−46.7%	0.39	−30.4%	0.17
Influenza, pneumonia	1181	29.7	1091	16.5	1261	17.9	−40.0%	0.17	8.4%	−0.03
Alzheimer's disease and other dementia	1041	26.2	2487	36.3	2726	37.2	41.8%	−0.15	2.5%	−0.02
Chronic liver disease and cirrhosis	269	6.8	463	8.1	480	8.1	20.2%	−0.03	0.7%	0.00
Suicide	459	11.6	604	12.4	427	8.7	−24.7%	0.07	−29.9%	0.10
Parkinson's disease	204	5.1	322	5.4	357	5.6	8.2%	0.00	2.8%	0.00
Primary hypertension and renal diseases	110	2.8	279	4.3	301	4.2	51.6%	−0.02	−1.2%	0.00
Drug overdose	272	6.9	369	8.1	528	11.7	70.7%	−0.15	43.9%	−0.12
Opioid and cocaine	64	1.6	128	2.9	192	4.3	166.3%	−0.08	48.0%	−0.04
Opioid w/o other drugs except cocaine	153	3.9	194	4.2	277	6.1	58.9%	−0.08	45.2%	−0.07
Cocaine w/o other drugs except opioid	55	1.4	47	1.0	58	1.3	−9.4%	0.01	23.9%	−0.01
Other drugs without opioid or cocaine	0		0		S					0.00
Other diseases (including undetermined causes)	4716	118.8	5486	92.5	7095	116.7	−1.7%	−0.14	26.2%	−0.63

Abbreviation: S, suppressed due to the number of death is less than 5.

[a] Contributing value is negative when mortality rate for a cause increased overtime and thus decreased the life expectancy at birth.

TABLE 2
Contributions of drug overdose to the life expectancy at birth inequalities (in years), by sex and deprivation level, British Columbia

Factor	2001 or 2011[a]		2016	
	Life expectancy difference	Contribution by drug overdose	Life expectancy difference	Contribution by drug overdose
Sex (male vs. female)[b]	−5.01	−0.20	−4.59	−0.42
Deprivation level (quintiles 5 vs. 1)[c]				
Material deprivation	−1.65	−0.16	−1.88	−0.16
Social deprivation	−5.62	−0.26	−5.43	−0.33
Total deprivation	−5.50	−0.31	−5.58	−0.39

[a] 2001 for the sex analysis and 2011 for the deprivation index analysis.
[b] Negative contribution represents a life expectancy at birth loss in males due to the higher drug overdose mortality.
[c] Negative contribution represents a life expectancy at birth loss in the population with the lowest socioeconomic status due to the higher drug overdose mortality. A low deprivation level value indicates a better socioeconomic situation (i.e. a lower level of deprivation).

(quintile 1 or the highest SES). Of this, 0.31 years were attributed to drug overdose deaths. The contribution by drug overdose increased to 0.39 years in 2016 (accounting for 7% of the gap). The inequalities by social deprivation were greater than that by material deprivation in both years.

Discussion

In this analysis, we found a 2.37-year increase in LE_0 from 2001 and 2016, but a 0.38-year decline from 2014 to 2016 (with 0.12 years attributed to drug overdose deaths). While the sex difference in LE_0 slightly narrowed between 2001 and 2016, the contribution by drug overdose deaths to the inequality doubled. During 2011 and 2016, LE_0 inequalities by deprivation level (between quintiles 1 and 5) were relatively stable, but the contribution by drug overdose deaths increased.

Between 2000 and 2015, drug overdoses contributed to 0.28 years lost in LE_0 in the USA. Of this, 0.21 years were attributed to opioid-involved overdose deaths.[5] In this analysis, we demonstrated that drug overdose deaths, specifically opioid overdose deaths, contributed to a considerable loss to LE_0 in BC. However, the contribution was smaller than in the USA due to the lower age-standardized morality rates (e.g. opioid overdose mortality rate in both sexes was 16.3 per 100 000 in the USA in 2015[5] and 11.9 per 100 000 in BC in 2016). LE_0 has improved over past decades in the USA, reaching the highest at 78.9 years in 2014, but slightly declined to 78.8 years in 2015 and to 78.6 years in 2016. The decline was largely due to the increased deaths in younger ages and deaths from unintentional injuries including drug overdose.[4,9] Similarly, we have found a LE_0 decline since 2014 in BC and the decline was partially attributed to increased drug overdose deaths, in particular in males. Other provinces have also experienced increasing drug overdose deaths,[10-12] but it is unclear how this will impact life expectancy at the national level.

Sex and socioeconomic inequalities in life expectancy at birth have been reported at different geographic levels.[13-16] While studies clearly showed the differences in life expectancy, little is known about the contributions of cause of death and risk factors associated with sex and SES. In this analysis, we showed that drug overdose deaths alone explained approximately 9% of LE_0 loss in males in 2016, compared to females. The contribution has doubled during the last 15 years due to the significantly increased drug overdose deaths in males. Drug overdose mortality rate for those in the lowest SES communities was 3 times higher than that in the highest SES communities (data not shown), accounting for 7% of LE_0 loss. These findings show the important impact that drug overdose deaths have had on the entire population of BC, and in particular, the differential negative impact on males and those who live in the most socioeconomically deprived areas of the province. This should further our resolve to address this largely preventable cause of death.

The contribution by drug overdose deaths may have been underestimated as only confirmed cases were included and coroners' cause of death can take up to two years or longer to determine. For 2016, BC Coroners Service reported 985 drug overdose deaths,[1] but by using vital statistics data, we identified 528 drug overdose deaths and over 1200 cases with undetermined causes of deaths. A significant proportion of these unspecified cases will likely be determined as opioid related, driving the contribution of opioid overdose deaths higher (likely greater than 50%). A recent study showed that 30% of drug-related deaths registered in the forensic toxicology registry in Sweden had not been recorded in the country's vital statistics database, resulting in an approximately 20% underreporting of drug-related mortality.[17] Including other data sources, e.g. forensic toxicological registry to identify additional drug-related deaths would further improve the estimation.

Conclusion

The life expectancy at birth for people in BC increased by 3 years between 2001 and 2014, but decreased by 0.38 years from 2014 to 2016. The opioid overdose crisis was an important contributor to this loss. The higher death rate from opioid overdoses was also a major contributor to a shorter life expectancy among males compared to females and to a shorter life expectancy for people from the most socioeconomically disadvantaged communities compared to those from the least disadvantaged communities.

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Conflicts of interest

The authors have no conflicts of interest to disclose.

Authors' contributions and statement

XY conceptualized the design of the study and wrote the initial draft. JS led data analysis. PK, BH and MT provided input to study design, analysis and interpretation of the data, and drafting and revising the paper. All authors have seen and approved the final manuscript.

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